Leland Initiative
U.S. Agency for International Development
Conakry, Guinea

Feasibility Study

University of Kankan Campus Network and Connectivity Project

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Executive Summary

Background

The University of Kankan, Guinea's second university, has approached USAID requesting support for their efforts to promote information technology and connectivity on campus. The University has already taken steps to build up their capacity in this area; many administrators have computers on their desks, and there is a small computer lab open to students on a highly restricted basis. This has all been accomplished on the University's own initiative and with the University's own funds. However, the current facilities are inadequate to serve the entire student body and faculty, and there is no network or Internet access.

Project Components

This study examines the feasibility of providing the University of Kankan with the following:

- A **campus-wide computer network** with a wireless backbone;
- Three years' worth of high-speed wireless **Internet access**;
- A **data center** including an email server, a web server, a file server, an intranet server, and centralized backup facilities;
- Computers for three **laboratories** for student and faculty use;
- Three years' worth of **maintenance and support**; and
- **Training** on all levels (students, faculty, and support staff).

The proposed project focuses on networks rather than on computers; see page 7 for further discussion of this concept. The University's highest priority at the point is to build a robust, high-speed network infrastructure that can accommodate future expansion and future Internet- or computer-based projects, whether funded by the University or by other donors.

The presence of one or two Peace Corps volunteers, working with this project full time over 2-3 years in a training and support role, is strongly recommended (see pages 14 and 30).

The University will need to provide the following:

- **Two full-time employees**: a network technician and a computer trainer (see page 29);
- **Office and laboratory space** to house the network and computer equipment;
- An increasing portion, eventually 100%, of the **recurring costs** of the network (see page 15); and
- **Housing** for Peace Corps volunteers assigned to the project.

Issues

Before any funds are committed to this project, the following issues need to be resolved:

- **Student and faculty access** to computer resources needs to be guaranteed (see page 12 for further discussion).
- Mechanisms for **training** administrators, professors, and students should be identified to ensure that the network will be used to maximum advantage (see page 15).
- The long-term **financial sustainability** of the network should be assured, including recurring costs for Internet access, network management, technical support, maintenance, and supplies (see page 15).

Direct Benefits

- Internet access and hands-on experience with computer technology would further the University of Kankan's goals of producing graduates with **modern job skills** and a global perspective.
- The ability to conduct research on the Internet would **decrease the isolation** of the faculty and student body.
- By publishing on the Web, students and professors would contribute to the accumulation of **African information and perspectives on the Internet**.

Indirect Benefits

In addition to the immediate consequences listed above, this project would:

- Build up the pool of **workers with technology skills** available to all sectors;
- Make it viable for private-sector independent Internet Service Providers (ISPs) to operate in Kankan, which would **introduce competition** into the field of Internet services in the region; and
- **Provide a model** for similar interventions in other institutions of higher learning.

Costs

The total cost of this project is estimated at $497,605. This breaks down as follows:

Line item		Cost
Network equipment		$118,550
Computer labs		$151,500
Data center		$50,900
ISP equipment		$28,350
Subsidy of recurring costs		$83,400
Total		$432,700
Unforseen expenses	15%	$64,905
Grand Total		$497,605

Further details are on page 17.

Introduction

Background and History

Kankan

Kankan, 800 km from Conakry in the *Haute Guinée* region, is Guinea's second city. The region, which shares a border with the Republic of Mali, is one of the poorest in the country. It is geographically isolated from the capital, Conakry; travel to Kankan by road takes at least a full day, and involves about 50 km of unpaved road and a ferry crossing over the Niger River. Flights to Kankan operate on an irregular schedule, and telephone service is unreliable. The Kankan region is, by some measures, the poorest in the country.

For all of these reasons, USAID/Guinea has concentrated many of its operations in the Kankan region. USAID partners working in the area include:

- Save the Children, which is pioneering innovative approaches to primary education in villages in the region
- PRISM, which works in reproductive health, STI/AIDS prevention, and family planning
- Pride, which provides micro-credit and training to small-scale entrepreneurs
- FICA, which collects and distributes agricultural marketing information

The University of Kankan

The University of Kankan is the nation's second university (after the University of Conakry). Enrollment has been growing steadily over the last few years and currently the student body numbers nearly 2000.

Academically, the University is divided into two *facultés* or schools: the *faculté des sciences naturelles* (school of natural sciences) and the *faculté des sciences sociales (*school of social sciences). Each school is led by a dean *(doyen)* and is further subdivided into departments as follows:

Sciences Naturelles	Sciences Sociales
Physiques	*Lettres et Linguistiques*
Mathématiques	*Économie*
Biologie	*Histoire-Géographie*
Chimie	*Philosophie-Sociologie*

The University of Kankan plays a key role in the Guinean educational system.

To enter the University, a student must have passed the national high-school exit examination *(baccalauréat)* and a competitive entrance examination. Upon admission a student is assigned to one of the two schools. Once the student has successfully completed two years, he or she receives the DEUG *(diplôme d'études universitaires générales)* and is tracked into one of the options within that school, based on either an examination or on the student's academic record. At the end of a total of four years, the student presents and defends a thesis *(mémoire)* and obtains a final diploma, called the *maîtrise.* There are no opportunities for postgraduate study within Guinea's university system.

The faculty consists of around 197 professors, mostly Guinean nationals, with a few expatriates from other African countries and usually one or two Peace Corps volunteers teaching English. Each departmental head has an office.

The campus of the University of Kankan is located near the center of the city; it occupies a block 200 m square, with 25 or so buildings. These include several dormitories (most students live on campus); a dining hall; a massive 4-story classroom building; a library/computer center; a faculty office building; and an administrative building, among others (see campus map, page 21).

Information Technology on Campus

The University, of its own initiative and with its own funds, has steadily invested in computer equipment over the last few years. At this point there are 23 computers in use on campus (see page 28 for an exhaustive inventory). These are all relatively late-model computers (with Pentium processors, running Windows 95 or later) and are distributed as shown to the right.

Administration	*10*
Faculty	*5*
Computer center	*8*

Distribution of the University's current computers.

In general, the University's computer equipment is underused. This is partly due to a lack of training, but also to an institutional tendency to restrict access to valuable resources.

The University has created a computer center with its own funds, which currently houses eight computers and three printers. In principle the computer center is open to the student body and faculty; in fact only fourth-year students who are taking or have completed certain classes are able to use them. At the same time, the University sells access to the center to the general public, which has meant in practice that students and professors who can afford to pay the same fees as walk-in customers have easy access to these resources while most of their peers do not. These issues are discussed in further detail on page 12.

None of the computers is connected to a network, and most mission-critical administrative and record-keeping tasks are still performed on paper.

The University's computer center.

Internet Connectivity in Kankan

Internet access has been available in Kankan since April 1999, when a high-speed VSAT gateway began operations. Sotelgui, the national telecom operator, houses and manages this gateway, which was financed by USAID's Leland Initiative, and sells dial-up subscriptions to individuals and organizations.

As of January 2000, there were around 75 Internet subscribers in upcountry Guinea; about a third of these are in Kankan. There are currently no leased-line subscribers in Kankan. Most of the first subscribers have been either expatriates or donor-funded projects, which use the technology to stay in touch with their offices and contacts overseas and to do research on the web.

There are, however, some notable exceptions to this profile: a local furniture-maker, for instance, was the first in line for an account, and uses his access to follow developments in woodworking technology and even shop online for new equipment and replacement parts.

There are currently no means for the general public to use the Internet. Only those who can afford their own computer equipment, phone line, monthly subscription, and source of electrical power (generator or solar) can get online.

One of the most important objectives of the Leland Initiative in Guinea is to encourage the creation of a thriving, competitive private-sector Internet services industry. This has been accomplished in Conakry, where two independent Internet Service Providers (ISPs) compete with Sotelgui; but it has yet to happen upcountry. At present Sotelgui is the only ISP in town.

One of the most significant potential side benefits of this project, then, would be the introduction of competition in the field of Internet services in Kankan. This would be accomplished by using the proposed network and connectivity project as leverage to make it viable for an independent ISP to establish a presence in Kankan. This idea is discussed in fuller detail on page 9.

The Need for Connectivity

The flow of information plays a critical role in any modern organization. This is especially true for universities, where research and education are the primary focus. The University of Kankan is constantly contacting and exchanging information with:

- Local and international research institutions
- International experts
- Universities around the world
- International non-governmental organizations (NGOs), private voluntary organizations (PVOs) and donors
- The University of Conakry and other institutions within Guinea's system of higher education
- The *Ministère de l'Éducation Supérieure* and other government ministries in Conakry

Of the means currently available for this communication, long-distance telephone and fax are expensive and, in practice, unavailable to anyone besides administrators and select faculty members; while traditional post is slow and unreliable.

Kankan's geographical isolation has long been one of the University's most critical handicaps. The administration has a hard time recruiting faculty; as professors are likely to prefer underemployment in Conakry to a tenured position in Kankan, which is separated from the capital by a long day's travel or an expensive long-distance telephone call. Students likewise often pass up a chance to study at the University of Kankan, holding out for admission in Conakry or abroad. Internet connectivity would make Kankan a much more attractive place to study and teach, as it would allow the student body and the faculty to communicate cheaply with the outside world, to conduct research, and to publish their work for a global audience.

Kankan's VSAT Internet gateway was installed with Leland Initiative financing in 1998-99.

Worldwide, universities have been at the vanguard of the movement towards open, global networks; the Internet itself has its origins as an academic network, now open to the general public. It is only fitting that the higher education sector in Guinea take the lead in exploiting new information and communication technologies, and that the University of Kankan be at the forefront in technology adoption in the Kankan region.

While Internet connectivity is the primary focus of this project, local connectivity is an important consideration as well. There is a great deal of intra-University information moving among the departments and the administration, including budget development, financial administration, personnel management, scheduling, class registration, and student records.

The University of Kankan and USAID's Strategic Objectives in Guinea

In addition to the direct benefits that the University would enjoy, this project would further USAID/Guinea's strategic objectives in the region. For instance:

- **Natural Resources Management:** The University could house a regional data collection and training center for the **GLOBE program**, an environmental monitoring and science education project led by Peace Corps volunteers and financed by USAID's NRM team.
- **Education:** Many of Guinea's **primary and secondary schoolteachers** come from the University of Kankan; early exposure to information technology will not only contribute to their training, but also prepare them for the eventual introduction of technology into their classrooms.
- **Health:** The University of Kankan **AIDS project**, which is funded by USAID grantee PRISM, could create an Internet-enabled resource center. This would

permit students and local people with AIDS to follow developments in research and to communicate with counterparts in other countries.

- **Democracy and Good Governance:** Students and faculty would gain experience in **democratic, representative self-government** in the form of campus network steering committees. In addition, they will be exposed to Internet governance structures, which are inherently liberal, decentralized, and democratic.

Experience with the Internet and with computer technology would benefit USAID's partner organizations in a broader sense, as it will build the pool of **workers with information technology skills**, including Internet research and publishing, available to organizations in all sectors of development; such workers are currently in critically short supply.

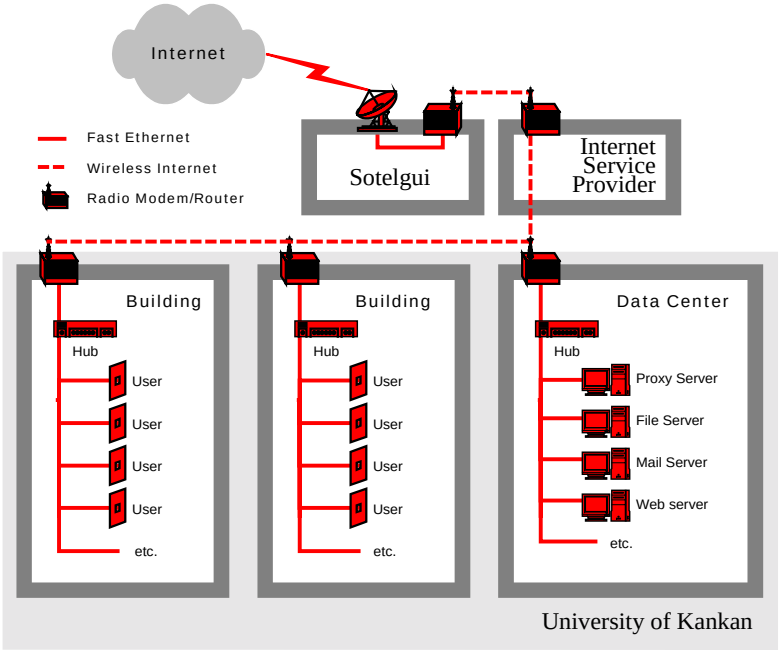
Vision and Desired Results

The Campus Network: A Foundation for Growth

The key to achieving the connectivity goals discussed above is a modern, high-speed data network covering the entire campus.

This vision focuses on networking rather than on computing resources. The following discussion is not about linking together the University's existing computers, or about buying new computers and linking them together. It is about building a robust, high-speed data infrastructure, covering all of the key buildings on campus, that will allow the University to make maximum use of whatever new computer equipment it acquires over the following years.

Thus, rather than try to foresee every possible use to which the University could put this network, we should seek to build a network that (1) reaches as far as possible into all of the University's current offices, classrooms, and other facilities; (2) is flexible, modular, and extensible; and (3) will be well-managed, maintained, and used in a fair and transparent manner. Structured this way, the project will lay a foundation able to support any applications the University comes up with in the future.



Architecture of the proposed network.

This network will be constructed in a modular fashion, in three steps:

1. **Local area networks** (LANs) will be installed in each of the targeted buildings.
2. Each LAN will be connected to a **high-speed campus backbone** in order to form a university wide area network (WAN).
3. The University WAN will be **connected to the Internet** through an Internet service provider.

It is worth noting that the above steps are not necessarily sequential; implementation can be sequential, parallel, or staggered.

In order to permit students and faculty to immediately begin taking advantage of this infrastructure, the project should include equipment for three small computer labs with 10-15 computers each. One of these would be reserved for faculty access; the other two would be open to the student body exclusively.

The network will cover the following buildings (see campus map, page 21; and network diagrams, page 22).

❶ Departmental Office Building	This building houses offices for all of the department heads.
❷ Main Block	The main block is a four-story building housing all of the University's classrooms, as well as several faculty offices, a language lab, and the English reading room.
❸ Library/ Computer Center	The library building has a reading room, a separate area for stacks, as well as the University's existing computer lab.
❹ New Laboratory Building	The University is building a second story on a dormitory block, which will eventually house all of the University's laboratories as well as a student computer laboratory.
❺ Infirmary/ Laboratory	The Infirmary houses the campus health center. The medical laboratories are also used for research and student lab work by the biology and chemistry departments.
❻ Guesthouse/ Business Center	The University is building a guesthouse for visiting professors and other guests. The business center will include a cybercafé open to the general public, which would generate revenues for the University.
❼ Rectorate	This building contains all of the university's administrative offices. Currently houses 10 computers.

Local Area Networks

The University already has a small number of relatively late-model computers, concentrated in the administration building *(rectorat)* and in the computer center. None of these computers are networked; but they only lack Ethernet cards to be network- and Internet-ready. The only Internet connection on campus is a single dial-up connection in the office of the director of external relations, which was recently installed.

The first step, then, is to build local area networks in each of the targeted buildings. Each LAN will consist of structured Fast Ethernet cabling, one or more hubs, and network outlets in all offices and rooms. Network cards will need to be installed in each of the 23 computers currently owned by the University. Any computer equipment purchased in the future should include network cards.

Campus Backbone

The second step is to connect all of the targeted buildings together in a campus-wide network. There are two possible technologies that could be used for this purpose: fiber-optic cable and wireless (radio modems). These two options would cost about the same. Fiber-optic would provide higher bandwidth, whereas wireless would be simpler to install and would be more modular and flexible, making it easier to extend the network to other buildings in the future.

Internet Access

The final step is to connect the University-wide network to an Internet service provider; this connection will then allow any computer on campus to access all of the resources of the Internet. This should be a high-speed link, built from the beginning to

be large enough to accommodate the University's growing demand for bandwidth over the next few years.

Choosing an access technology

Here again, there are wireless options and landline options. A landline approach would likely involve a 64 Kbps leased line such as those used by the ISPs in Conakry to obtain their access from Sotelgui. The wireless options are largely the same ones discussed above for the campus backbone. A wireless connection would be faster (up to 10 Mbps) and would allow more flexibility.

Choosing a service provider

The choice of an Internet service provider is a critical one. One of the most important objectives of the Leland Initiative in Guinea is to develop a thriving private-sector Internet services industry. This has been successfully accomplished in Conakry; following the installation of the first high-speed Internet gateway in Guinea in 1997, two private enterprises entered the field, Mirinet (BINNTA) and ETI-Bull. Together they currently account for about four fifths of the total dial-up Internet market in Conakry; they provide Sotelgui with strong competition, provide customers with a viable alternative, and in general are valuable partners in USAID's efforts to develop the Internet sector in Guinea.

At present Sotelgui, which houses and manages the Leland-financed Internet gateway, is the only source for Internet services in Kankan. This is unfortunate, as it serves to reinforce Sotelgui's monopoly over telecommunications services in Guinea, and leaves upcountry customers with no other option for Internet access. The private ISPs currently operating in Conakry have expressed an interest in setting up shop upcountry ever since the secondary-city connectivity project was initiated; but until now the risks involved have been perceived as too great considering the limited market for Internet services outside of Conakry.

With all this in mind, it makes sense to look at ways to use the present University connectivity project to encourage private ISPs to establish a presence in Kankan. Specifically: the University should outsource the management of its Internet connection to an independent provider, which would be connected in turn to Sotelgui's gateway. Not only would the University be far more likely to have a satisfactory level of customer service than if it bought its access directly from Sotelgui, but the introduction of competition in the field of Internet services would benefit the entire region.

Network Services

Every computer on the campus network will be able to use Internet protocol (IP). This is the network layer that allows users to access all of the services of the Internet—meaning, on the client side, web, email, FTP, streaming media, instant messaging, telnet, and so on.

In order to maximize the utility of the network to its users, the University should also offer the following network services on the server side:

Email Service

Every student, professor, and administrator should have his or her own mailbox and email address. There is no reason not to provide this service to the entire university community. Email is the most easily understood and most effective tool offered by the Internet; and additional email users place a relatively small additional burden on network resources. Universally available email has the added advantage of providing the University community with an efficient means of internal communications.

Email services—and all services built onto this network—should be implemented according to open Internet standards (POP3, SMTP, LDAP, etc.); non-standard, proprietary solutions will only make network administration more difficult and limit the users' choices for client software.

Web Hosting

A key theme of this study is that Internet connectivity should not only promote access to information from other countries, but also the digitization of African knowledge and the contribution of African voices to the Internet. With this in mind, the University should provide space on a web server to students and faculty, entitling each student and professor to a small amount of web space (10-20 MB), with additional space made available to those who need it.

In order to help students learn the fundamentals of web design and publishing, the University should match interested students with local organizations desiring to establish an Internet presence. Other African universities have actively encouraged the formation of "webmasters' clubs," which provide students with an opportunity to exchange advice and build each other's skills in web design.

The rectorate should also direct the creation of an official University of Kankan website, which would provide information about the institution and act as a portal to web content generated on campus.

Domain name

An Internet domain name should be reserved as soon as possible for the university, for example, *ukankan.ac.gn* (*.gn* is Guinea's top-level national domain, and *.ac* is the second-level domain reserved for academic institutions). Thus, the university's web address would be *www.ukankan.ac.gn*, and email addresses would be of the form *studentname@ukankan.ac.gn*.

The *.gn* domain is now being administered on a voluntary basis by an independent Guinean living in Conakry, M. Mamoudou Keita of Orstom. Assignment of Internet domains is free for validated entities with a physical presence in Guinea.

Remote vs. local hosting

The University web server could be located on campus, or it could be hosted in the US or elsewhere. It would make no difference to the user in terms of the site's appearance and in terms of locating the site and its content; the web address would be same in either case, and Internet search engines do not care where the content is physically located. University content providers (students and faculty publishing on the web) would not see much of a difference either; they would be able to easily maintain their websites via FTP, and the network staff would take care of housekeeping on the server via Telnet.

The advantages of hosting the site remotely have to do with speed and reliability of access for a worldwide audience. Many organizations in the US are beginning to outsource their web hosting; large commercial server farms are better equipped than most organizations to provide fast and dependable web hosting, with redundant high-speed connections to the Internet backbone, uninterruptible power supply, data backup, and so on.

It is also possible that a university in the US or Europe would be willing to host the University of Kankan's web server as a public service. This would have the same advantages of a commercial web host (speed, reliability) and would have the added benefit of being free.

The advantages to hosting the site locally are both symbolic and educational. Hosting an actual website in Kankan would be a significant accomplishment in its own right; and students would be able to gain hands-on experience with the maintenance of a

physical web server. The disadvantage would be that users outside of Kankan would likely find access to the University website frustratingly slow.

A third approach that would combine the benefits of both would be to have an on-campus server with a mirror image maintained remotely, either by a commercial host or by a remote university. A user accessing the site from Kankan would be directed to the local server, while users elsewhere in the world would access an identical site at the remote host. The remote host would periodically synchronize with the local server to ensure that both servers hold exactly the same content throughout.

A note about bandwidth

Currently Labé, Kankan, and Nzérékoré all share a single block of bandwidth, which consists of a 512 Kbps downlink and a 128 Kbps uplink. To the user, this means that it is much faster to receive data from the Internet than to send data to the Internet.

This is a sensible arrangement for most users; incoming data consists of web pages, graphics, streaming media, and so forth, whereas outgoing data primarily consists of mouse clicks and email messages, neither of which takes up much bandwidth.

However, this arrangement assumes that users behind the gateway are primarily consumers of information; if the University of Kankan is to become a serious producer of Internet content, whether this involves hosting a live web server or simply uploading content to a remote server, it will require a more capacious uplink.

Centralized File Storage and Backup

In a university setting, students are generally not assigned their own computer, but use whatever computer is available in a laboratory. Students therefore need a centralized place to store their data so that they can access it from any computer on campus. The University should maintain a high-capacity file server with space set aside for each student, faculty member, and administrator, so that each user has access to his or her files when logging on from any machine.

Procedures should also be put in place to set aside server space for working groups needing to share files, whether permanently or over the duration of a specific project.

Network staff will need to take steps to ensure that this server is secure and configured such that each user is only able to access the directories he or she is authorized to use.

Centralized file storage will also allow data backup services, performing a university-wide backup at fixed intervals (preferably every day) so that lost or damaged files can always be reconstructed.

Intranet and Administrative Applications

An additional server should be dedicated to the task of providing internal data management services to University faculty and staff. This would allow the University to eventually develop applications to computerize administrative tasks such as managing student records, class registration, payroll, budgeting, and class scheduling. A campus Intranet would permit the University to make certain administrative data available to the students and professors via a simple web browser interface.

Organizing for Effectiveness and Sustainability

The easiest part of a project of this sort is buying and installing the computer and network equipment. It rather more difficult to ensure that, in the long term,

- The facilities installed will be used as intended;
- The equipment will be kept up;
- The receiving institution will be able to afford ongoing expenses; and
- The intended users know how to make good use of the technology.

Perhaps the most important contribution of this effort will be to resolve these issues globally, so that subsequent donors of computer equipment will be reassured that questions of fair use, maintenance, training, and sustainability have already been addressed.

Enabling Student and Faculty Access

This project is primarily intended to benefit the students and faculty of the University of Kankan. As is common with establishments of this sort, there is an institutional tendency when managing valuable resources (1) to favor the administration over the faculty, and the faculty over the student body (meaning in this case that two-thirds of the University's computer resources are on administrators' desks); and (2) to be very restrictive in general over access to resources.

The administration rightly points out that today the University only has at this point seven computers available for student use, and nearly 2000 students. However, one would expect in those circumstances for the lab to always be at 100% capacity, whereas it has been empty or nearly so every time we have visited it.

There are several explanations for the underutilization of the University's existing computer resources. The administration has expressed concern that students and professors who don't know how to use computers will damage something, and so rules have been established to allow access only to those who have undergone some sort of training.

However, there are more serious organizational obstacles to student access. The University, with a view to making the computer center pay for itself, has opened up access to the general public for hourly fees, and also offers computer training to customers for a price. In principle, this would not be not a bad way to use otherwise idle computer equipment; and the administration has generously reduced the fees in half for persons associated with the University. In fact, however, the result of this policy has been that only those students and professors who are able to pay can use the computer center (whether they've been trained or not), while the bulk of the student body and faculty is denied access.

So in effect the University, whether or not it intended to do so from the outset, has institutionalized a system of charging students for access to University computers and for training. The administration has little incentive therefore to open free access to a greater number of students, as this would cut into revenues.

This is an issue that needs to be confronted from the outset. Before any commitment of funds is made to the University, the administration should establish new policies for its computer facilities that will guarantee access on an equitable basis to students and professors. The following principles should be respected by these policies:

1. **Students and faculty members should always have priority** over paying customers. Computer resources should only be open to the paying public when idle (which, considering the student-to-computer ratio at the University, should not be very often).
2. **No student should ever be required to pay** for computer *access* (although it would be fair to charge for use of supplies such as paper and toner).
3. **Every student and every professor** should have access to computer facilities and to the full range of network services (email, web hosting, etc). If necessary, priority can be given to students enrolled in computer-specific courses, but idle computers should be available for use by any student. (During the first semester or so of the network's operation, it may be necessary to make network services available to a smaller sample of the student body, in order to set up good administrative policies; but in the long term these services should be universally available).
4. **Computer facilities for students, professors, and administrators should be separated**, so that these groups are not competing with each other for computer resources.

But it will not be enough to agree in writing to these principles or to enshrine them in University policy. The donor—in this case USAID—needs to put in place mechanisms to (1) verify whether or not these principles are in fact being followed; and (2) take steps to remedy the situation if this turns out not to be the case.

Let's look at each of these requirements in turn:

Verification Mechanism

As the donor agency, USAID needs a way to follow up on the network over the medium term (2-5 years) to determine whether it is being used in the way it was intended.

USAID should require periodic reports on the state of the network. Each segment of the University community needs to be heard from separately: the student body, the faculty, and the administration. This is not as simple a matter as it may seem. There is currently no student organization that could be said to legitimately represent the concerns of the entire student body. The faculty, on the other hand, is represented by two competing teachers' unions with ties to the government and the opposition, respectively.

A solution would be for the University to create two independent and democratically elected oversight committees for the campus network: one for the student body, and one for the faculty. These committees would periodically and separately (1) report on the management of the network; (2) voice the concerns of their respective constituencies; and (3) make suggestions for improving the quality of services on the network.

The bylaws of these organizations should be negotiated and approved by the University beforehand, and should constitute part of the Memorandum of Understanding signed between the University and USAID.

It is worth pointing out here that these organizations would provide students and faculty with experience in democratic representation and governance, which, if successful, would be an important side benefit to this project.

Enforcement Mechanism

Rather than fully subsidize Internet access, maintenance, and other recurring costs during the first two or three years of operation, USAID should take the same amount of money and distribute it over several years. This subsidy would then be renewable every 6 or 12 months, contingent on the reports filed by the organizations proposed above. This will allow continued leverage for ensuring transparent and equitable administration of the network. For instance, three years' worth of subsidies could be distributed as shown to the right. Issues of recurring expenses and sustainability are explored in more detail below.

The underlying assumption is that the longer the students enjoy equitable access to network resources, the more difficult it will be to deprive them of this access in the future.

The decentralized design of this project should also serve to protect student and faculty access to network resources over the long term. Rather than create a large, central computer lab—to which individual administrators could easily restrict access—this project encourages the creation of many small, decentralized laboratories, which will be much harder to control.

Year 1	100%
Year 2	80%
Year 3	60%
Year 4	40%
Year 5	20%
Year 6	0%

Distribution of USAID subsidy for the University network's ongoing costs.

Physical Infrastructure

Kankan's municipal power supply is so unreliable that for the purposes of this discussion we will assume it does not exist.

The University is self-sufficient in power, with three diesel generators with a combined capacity of 270 KW. These generators currently run from 8:00 am to 12:00 pm and from 6:00 pm to 1:00 am, for a total of 11 hours a day.

The additional computer equipment contributed by this project will be on its own electrical network, supported by an additional diesel generator. This generator should have a capacity of between 100 and 125 KW in order to accommodate equipment added to the network in the future.

The fuel costs for this generator will need to be taken into account in the University's long-term budgeting; see page 18.

The data center, as well as all network hubs and routers, will need to be supplied with stable, uninterrupted electrical power 24 hours a day: email and web servers need to be permanently connected to the Internet in order to receive messages and deliver web pages. This will be provided by small, autonomous arrays of solar panels with storage batteries. In order to keep the costs for solar equipment down, servers and equipment in the data center should be selected and/or configured with energy efficiency in mind. Servers should have 12V DC power supplies so that they can be powered directly from batteries. All of the servers can share a single low-power flat-panel LCD monitor.

All rooms and offices in the rectorate, the departmental office building, and the library/computer center are air-conditioned. It is highly recommended that all rooms accommodating computer equipment be air-conditioned; this is not so much to protect equipment from heat (except in the data center, where the racks of equipment will need to be kept cool) as it is to allow the rooms to be sealed and protected from dust. However, this project will not provide air-conditioning equipment; this will be the responsibility of the University.

Network Management, Technical Support and Maintenance

The contractor responsible for installing the network should also be responsible for network maintenance and management, as well as training of University staff and student network management interns, for a predefined period of time.

In the long term, all computer equipment on the campus should be covered by a single, consolidated hardware maintenance and repair contract with a local firm, preferably one with a permanent presence in Kankan.

These costs should be subsidized on a progressively diminishing scale as discussed above.

The University should hire at least two new employees, one to work as a network manager and the other to work as a trainer (see below, and proposed scopes of work,

page 29). Ideally, each of these employees will have a Peace Corps volunteer counterpart, who will provide technical assistance and training (see proposed description of volunteer service, page 30). In addition, the contractor responsible for installing the equipment will be required to work with these employees, providing training as the installation proceeds and upon completion of the installation.

Student interns, by helping manage and maintain the network, could gain hands-on experience with computer and network technology while providing the University with a valuable service.

User Training and Classroom Instruction

In order to be able to take advantage of the resources provided by this network, the student body, faculty, and administration will need to receive training on various aspects of computer and Internet use.

An employee of the University, hired for that purpose, will provide this training (see proposed scope of work, page 29); a Peace Corps volunteer would help provide training during the first 1-3 years of the project, and help train the local trainer during this time as well.

For the administration and faculty, this training will take place in the form of extracurricular sessions. For the student body, the training should be integrated into the University curriculum as much as possible. An introduction to computers and the Internet should eventually come to be part of a first-year student's required coursework. University professors in certain subject areas should ultimately be able to provide relevant computer training where applicable to their courses.

Training modules offered should include:

- Introduction to computers and the Internet
- Word processing (Microsoft Word)
- Spreadsheets (Microsoft Excel)
- Web site design and creation
- Fundamentals of network administration

Long-term Financial Sustainability

As outlined above, the recurring costs of this project will be subsidized by USAID for an initial period. The cost of three years' worth of subsidies will be spread out over five years, so that the University takes on increasing financial responsibility for the costs of maintenance, supplies, and Internet access.

Recurring costs will include:

- Internet access fees
- Salaries for network and training staff
- Maintenance contract fees
- Equipment repair and upgrades
- Supplies (paper, toner, disks, etc.)
- Fuel for generating electrical power

The total recurring cost of the network is estimated at $27,800 per year; details are on page 18.

The University can help mitigate these costs by:

- Selling computer access and Internet services to the community
- Offering computer training to the community
- Charging per-use fees to users to pay for supplies (i.e. per page printed)

As discussed above, these activities must be conducted in such a way that they do not become an end in themselves and hinder student and faculty access to the University's computer resources.

These activities will not be enough to cover anything but a fraction of the recurring annual costs of the network; and the University will need to commit to making room for these expenses out of its budget once the subsidy period expires.

Costing

Detailed Project Costs

Network Equipment	Qty	Unit Cost	Total
Network cards	23	$250	$5,750
Switches (12-port)	20	$500	$10,000
Cabling (meters, installed)	1700	$4	$6,800
Wireless nodes	9	$4,000	$36,000
Installation, configuration, & training	1	$20,000	$20,000
Generator & spare parts	1	$40,000	$40,000
Total			$118,550

Computer Labs	Qty	Unit Cost	Total
Computers (incl. UPS)	45	$3,000	$135,000
Printers	10	$1,500	$15,000
Scanners	3	$500	$1,500
Digital cameras	3	$500	$1,500
Total			$151,500

Data Center	Qty	Unit Cost	Total
Servers	5	$4,000	$20,000
Solar power supply	1	$25,000	$25,000
Monitor & switch	1	$1,500	$1,500
Rack	1	$1,400	$1,400
Toolkit	1	$500	$500
Laptop computer	1	$2,500	$2,500
Total			$50,900

ISP Equipment	Qty	Unit Cost	Total
Remote Access Server	1	$5,000	$5,000
Hub	1	$500	$500
PPP Server	1	$2,500	$2,500
Router	1	$6,100	$6,100
UPS	1	$1,000	$1,000
Rack	1	$750	$750
Workstation	1	$2,500	$2,500
Solar power system	1	$10,000	$10,000
Total			$28,350

Subsidies for Recurring Costs

USAID will pay the equivalent of three years' worth of recurring costs for the network project. This cost is estimated at $2,000 per year. This subsidy will be spread out over five years as shown below.

Recurring costs	Qty	Unit Cost	Total
Internet access (per month)	12	$750	$9,000
Staff salaries (per year)	2	$3,600	$7,200
Generator fuel (per month)	12	$500	$6,000
Maintenance & support (per month)	12	$200	$2,400
Supplies (per month)	12	$100	$1,200
Equipment repair & upgrades (per month)	1	$2,000	$2,000
Annual total			$27,800

USAID subsidy		UK pays	USAID pays
Year 1	100%	$0	$27,800
Year 2	80%	$5,560	$22,240
Year 3	60%	$11,120	$16,680
Year 4	40%	$16,680	$11,120
Year 5	20%	$22,240	$5,560
Year 6 & on	0%	$27,800	$0
Total	300%		$83,400

Summary of Project Costs

Line item		Cost
Network equipment		$118,550
Computer labs		$151,500
Data center		$50,900
ISP equipment		$28,350
Subsidy of recurring costs		$83,400
Total		$432,700
Unforseen expenses	15%	$64,905
Grand Total		$497,605

Appendices

Appendix A: Minimum Technical Specifications

Network

Network cards	10/100BaseT auto-detecting
Switches	12 ports, 10/100BaseT auto-detecting, 220V power supply
Cabling	Cat5 Ethernet (4 pair, twisted)

Computer Labs

Workstations	Pentium III, 500 MHz, 10 GB HD, 64 MB RAM, 32X CD NIC 10/100BaseT auto-detecting, 220V power supply Windows 2000, MS Office 2000
Monitors	15” 1280x1024, 220V power supply
UPS	420W, 4 outlets, 20 min. runtime
Printers	17 ppm, 1200 dpi, 8 MB RAM, 600 pages, 10/100 Base T network card, 220V power supply
Scanners	1200 x 2400 dpi, 36-bit color, 8.5” x 11.5”, 220V power supply
Digital cameras	1280x960 image resolution; 8MB flash media

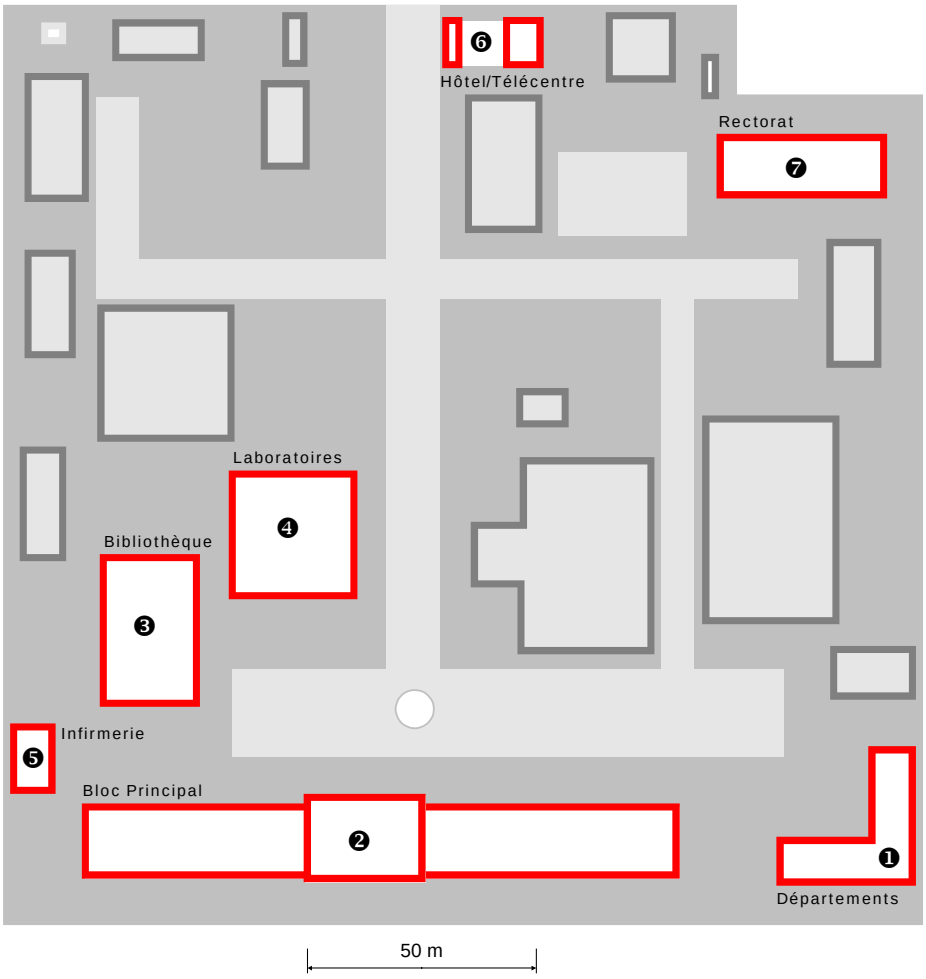
Data Center

Servers	Pentium III, 500 MHz, 20 GB HD, 256 MB RAM, 32X CD, 10/100BaseT auto-detecting network card, **12V DC power supply**; OS: Linux
Monitor	15” XGA active matrix LCD panel; 12V DC power supply; 5-way monitor/keyboard/mouse sharing switch

ISP Equipment

Remote Access Server	16 ports, 56K
Hub	12 ports, 10/100BaseT auto-detecting
Router	Cisco 3600
UPS	1400W, 6 outlets, 20 min. runtime
PPP Server	Pentium III, 500 MHz, 10 GB HD, 64 MB RAM, 32X CD NIC 10/100BaseT auto-detecting network card, 220V power supply; OS: Linux
Workstation	Pentium III, 500 MHz, 10 GB HD, 64 MB RAM, 32X CD NIC 10/100BaseT auto-detecting, 220V power supply Windows 2000, MS Office 2000

Appendix B: Campus Map

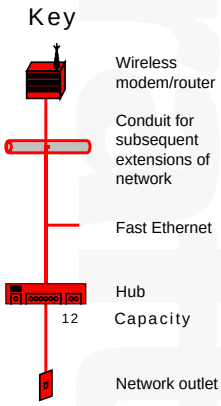


Seven buildings would be covered by the campus backbone: ❶ the departmental office building, ❷ the main block, ❸ the library/computer center, ❹ the new laboratory building (construction to begin February 2000), ❺ the infirmary/laboratory, ❻ the guesthouse/business center (currently near completion), and ❼ the rectorate.

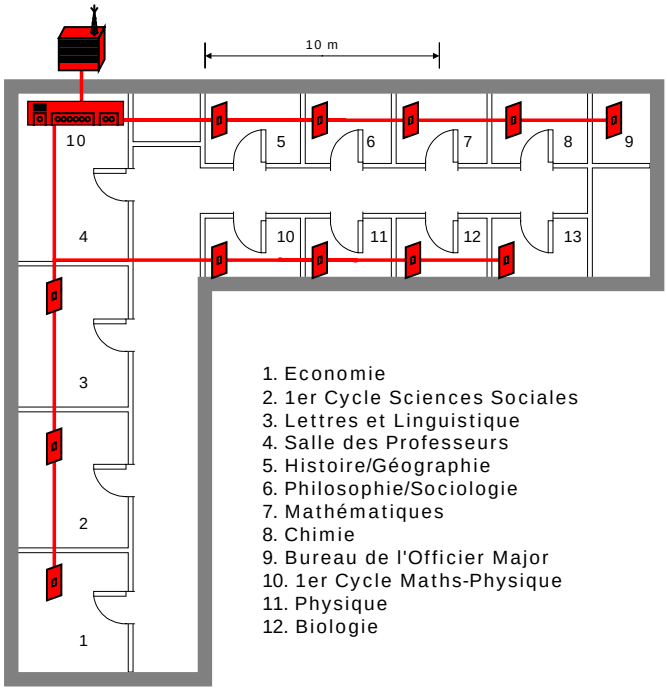
Diagrams of these buildings with suggested local area network (LAN) layouts are on the following pages.

Appendix C: Network Diagrams

Please note that the following diagrams indicate the proposed placement of **network outlets**, not necessarily computer workstations. The campus network proposed in this document is intended to provide a data infrastructure that will meet the University's needs for the next few years and accommodate new computers as they are acquired, rather than simply link together its existing computing resources.

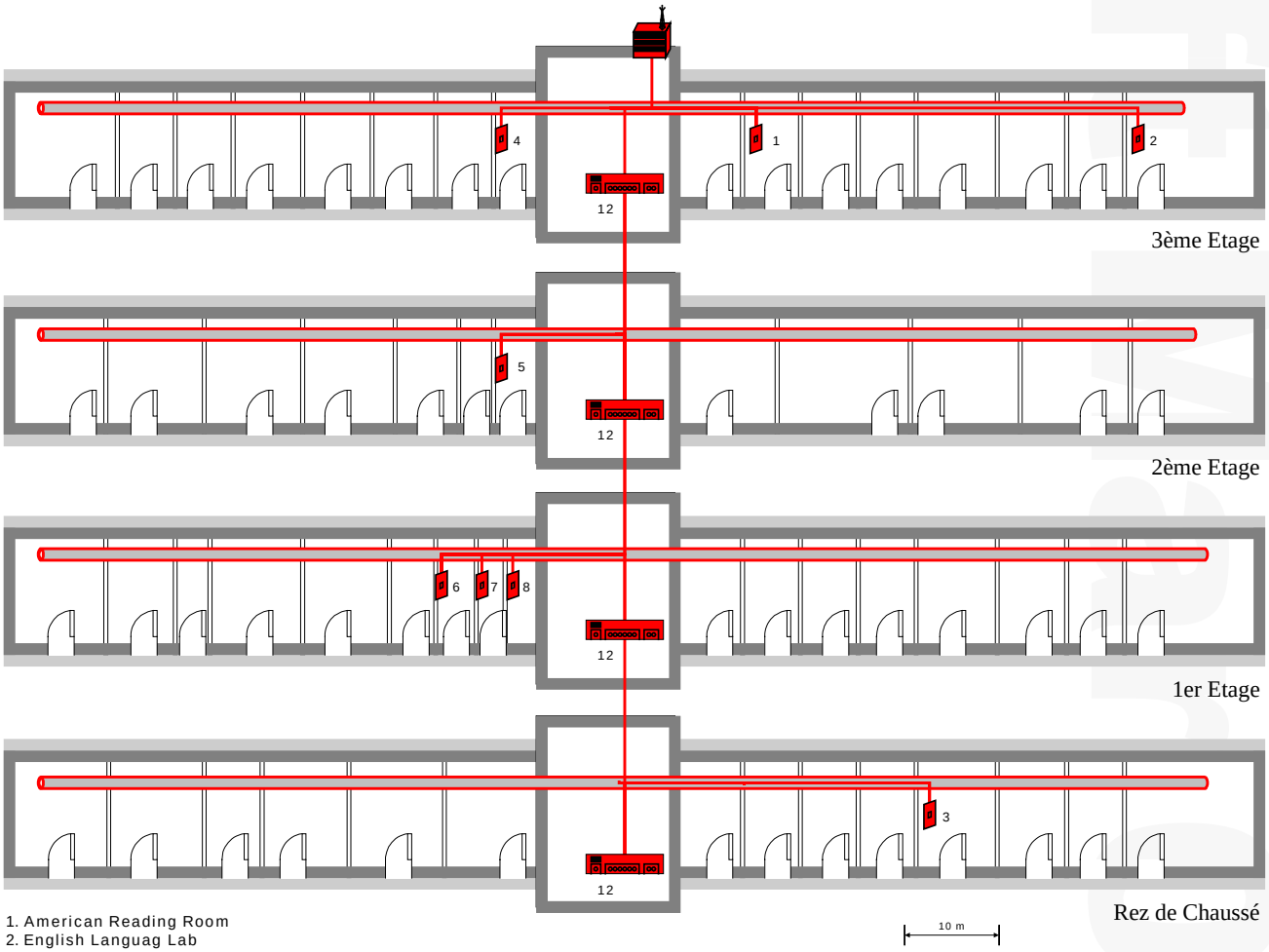


❶ Departmental Office Building



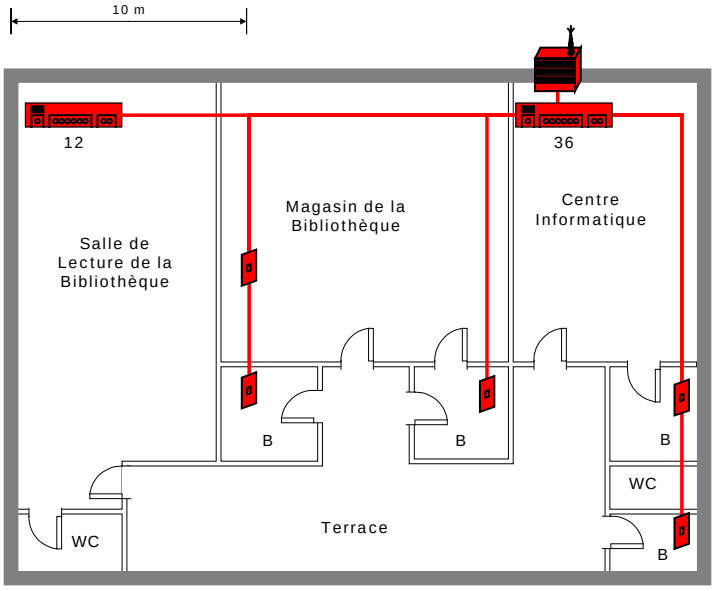
1. Economie
2. 1er Cycle Sciences Sociales
3. Lettres et Linguistique
4. Salle des Professeurs
5. Histoire/Géographie
6. Philosophie/Sociologie
7. Mathématiques
8. Chimie
9. Bureau de l'Officier Major
10. 1er Cycle Maths-Physique
11. Physique
12. Biologie

❷ Main Block

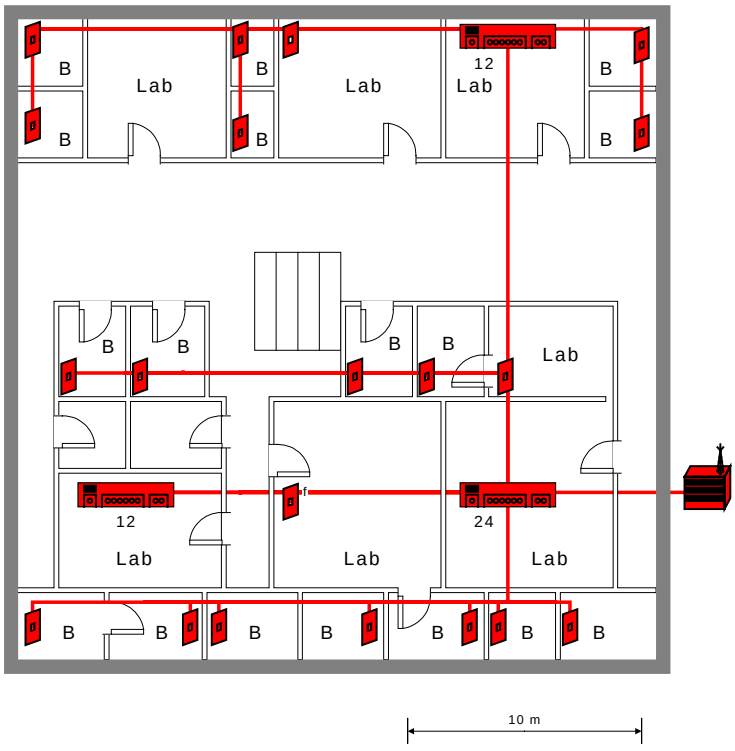


1. American Reading Room
2. English Languag Lab
3. Direction Central des Oeuvres Universitaires
4. Departement de Biologie
5. Departement de Physique
6. Vice-Doyen des Sciences Naturelles
7. Secrétaire du Doyen
8. Doyen des Sciences Naturelles

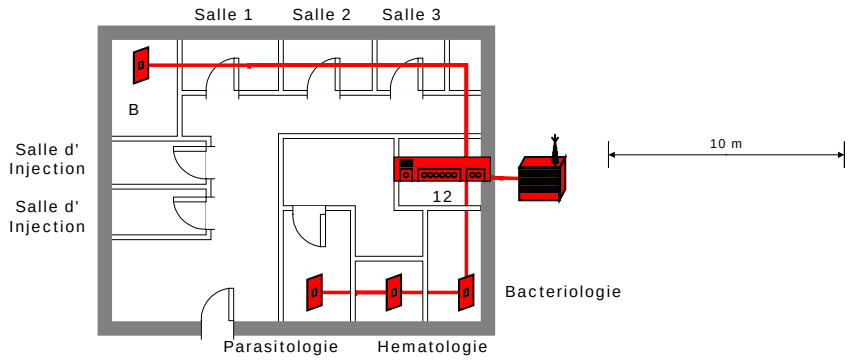
❸ Library/Computer Center



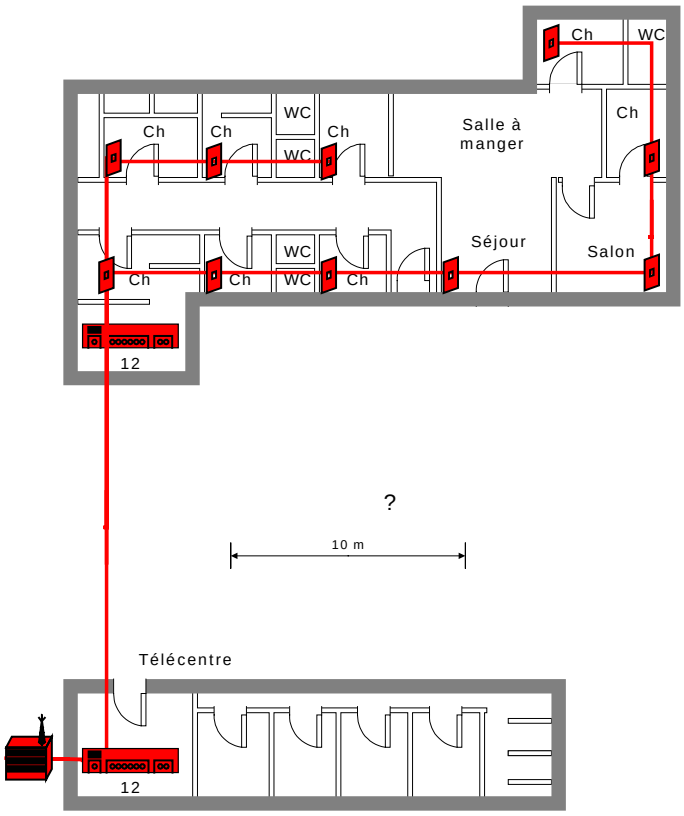
❹ New Laboratory Building (planned)



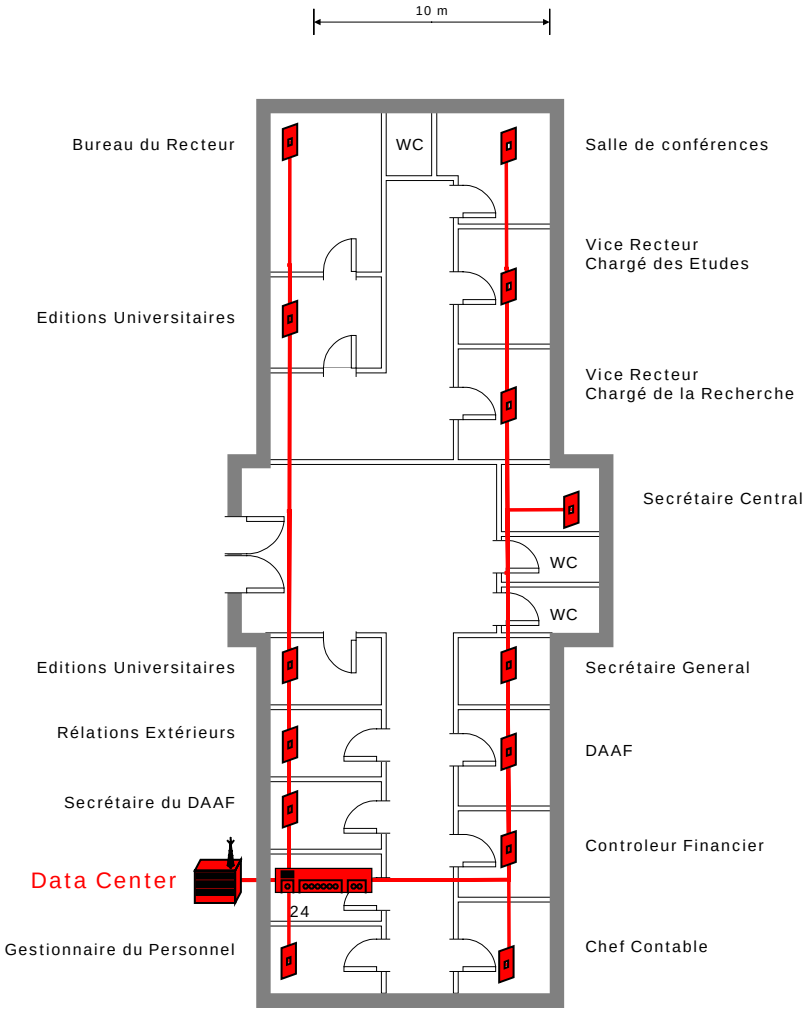
❺ Infirmary/Laboratory



❻ Hotel/Business Center (under construction)



❼ Rectorate



Appendix D: Inventory of Existing Equipment

Office	Brand	Mhz	MB RAM	HD (GB)	OS	Qty
Rectorate						
Vice recteur études	P-Bell	160	16	1.7	95	1
Vice recteur recherches	P-Bell	233	28	2	98	1
Secrétariat particulier	P-Bell	166	16	1.6	95	1
Secrétariat Central	P-Bell	166	16	1.6	95	1
Secrétariat général	P-Bell	166	16	1.6	95	1
Relations extérieures	Compaq	150	24	2	95	1
Secrétariat DAAF	P-Bell	166	16	1.6	95	1
Secrétariat DAAF	P-Bell	233	28	2	98	1
Contrôle financier	P-Bell	166	16	1.6	95	1
DAAF	IBM	350	64			1
Library/Computer Center						
Computer Center	P-Bell	166	16	1.6	95	7
Director of Computer Center	P-Bell	233	28	2	98	1
Main Block						
Sciences Sociales	P-Bell	160	16	1.7	95	1
Sciences Naturelles (Secr.)	Generic					1
Lettres & Sciences Humaines	P-Bell	166	16	2	95	1
Chimie (Doyen)	IBM	25	1	0,3	DOS	1
Sciences Sociales (Doyen)	P-Bell	166	16	1.6	95	1
Total						**23**

Appendix E: Scopes of Work

The following two scopes of work define the responsibilities and desired qualifications for the University employees that will need to be hired.

Network Technician

Responsibilities

- Maintain the University computer network, including network hardware (routers, hubs, cabling) and services (email, web, and file servers)
- Develop information management applications identified as priorities by the administration and faculty (budgeting, student records, library digitization, etc.)

Desired qualifications

- Some experience with Ethernet networks and Microsoft NT or Linux servers, whether professionally or informally
- Experience in computer hardware maintenance and repair is desirable
- Experience developing database applications is desirable

Computer Applications Trainer

Responsibilities

- Design and teach introductory university-level classes for students and conduct training workshops for professors and administrators in basic computer use, Internet-based research, productivity applications, web publishing, etc.
- Coach students interested in web design
- Train student lab monitors and assistants

Desired qualifications

- Familiarity with basic Internet and productivity software (web, email, word processing, spreadsheets, web page design)
- Experience developing database applications is desirable

Appendix F: Descriptions of Volunteer Service

These descriptions constitute Statements of Work for the two Peace Corps volunteers being recruited to assist the University in user training and network management.

Network Administrator, University of Kankan

Host Institution

University of Kankan (Kankan, Guinea)

Background

The University of Kankan is Guinea's second university. At 800 km from the capital, the University has long suffered from its geographical isolation. In order to build on the successful installation of an Internet gateway in Kankan in 1999, USAID is planning to install a modern data network at the University, with a high-speed connection to the Internet and student laboratory facilities. This network is projected to be in operation by the beginning of the next school year (September 2000).

This project is modeled in part on the highly successful University of Jos computer network, which owes its success in large part to the presence of an American Fulbright scholar. More information on this project is available at *http://intlinet.lib.uiowa.edu/josproject/Projects* .

Hardware repair, maintenance and technical support will be contracted out to a local firm, but it is critical for the long term that the University have the in-house capacity to maintain the network and to develop information management systems to run on the network.

Responsibilities

The volunteer will be a member of the University staff and will work with a Guinean counterpart and student interns to provide the following services

- Maintain the University computer network, including network hardware (routers, hubs, cabling) and services (email, web, and file servers)
- Develop information management applications identified as priorities by the administration and faculty (budgeting, student records, library digitization, etc.)
- Work with University staff and student interns to develop local capacity to perform the above tasks

Desired qualifications

- Some experience with Ethernet networks and Microsoft NT or Linux servers, whether professionally or informally
- Experience in computer hardware maintenance and repair is desirable
- Experience developing database applications is desirable
- French proficiency required

Computer Applications Trainer, University of Kankan

Host Institution

University of Kankan (Kankan, Guinea)

Background

The University of Kankan is Guinea's second university. At 800 km from the capital, the University has long suffered from its geographical isolation. In order to build on the successful installation of an Internet gateway in Kankan in 1999, USAID is planning to install a modern data network at the University, with a high-speed connection to the Internet and student laboratory facilities. This network is projected to be in operation by the beginning of the next school year (September 2000).

This project is modeled in part on the highly successful University of Jos computer network, which owes its success in large part to the presence of an American Fulbright scholar. More information on this project is available at *http://intlinet.lib.uiowa.edu/josproject/Projects* .

Training has historically been the weak link in projects of this sort. In order for the University to take maximum advantage of its computer resources, training for students, professors, and administrators will be required, as well as training of trainers to guarantee the long-term sustainability of the project.

Student and professor access is also a critical issue for the success of this project. To date, the University's computing resources have not been available on an equitable basis to the student body or the faculty, and one of the most important tasks of the volunteer filling this position would be to work with the university to create appropriate policies to ensure universal access to the computer facilities.

Responsibilities

The volunteer will be a member of the University faculty and work with a Guinean counterpart and with student interns to provide the following services:

- Design and teach introductory university-level classes for students and conduct training workshops for professors and administrators in basic computer use, Internet-based research, productivity applications, web publishing, etc.
- Train trainers to conduct these workshops and classes
- Coach students interested in web design
- Work with the administration to develop policies for student and faculty access to the University's computer labs
- Train student lab monitors and assistants

Desired qualifications

- Familiarity with basic Internet and productivity software (web, email, word processing, spreadsheets, web page design)
- Experience developing database applications is desirable
- French required